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ABSTRACT

Relatively few individuals have attempted to view the future of computers in education, and those who have done so often tend to focus too much upon present capabilities rather than thinking about the changes that new technology will introduce in the future. George Leonard's book "Education and Ecstasy" provides an interesting picture of what schools in the year 2001 may be like. He suggests that through extended computer technology students will be motivated to learn and that they will learn all basic information, including calculus, between the ages of three and ten. In the book students interact directly with the computer which monitors the student's progress in all subject areas. Children are depicted as linked directly to the computer through headphones that pick up the child's brain signals and indicate to the computer whether the child is comprehending the lesson. The implications of Leonard's book are worthy of serious consideration despite the resistance that computer assisted instruction may face in the near future. (DGC)

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George Leonard's View of the Computer in Education

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Workers developing educational materials using the computer can, and often do, simply start where they are, with whatever equipment they can acquire, and chip away at courses.

However, effective long-range plans must be much more systematic and detailed. We can often distinguish readily between short-range goals, what we are immediately trying to do with projects, and long-range goals. Long-range goals can be formulated only if we decide how the future should be shaped. Individuals with strong views about the future, with powerful ideas about what role computers should play in education twenty or twenty-five years from now, not only offer guidance, but may well influence the future; a prophecy of this kind can be a self-fulfilling prophecy.

Relatively few have attempted to view the future of computers in education. Developers who continue working where they are, with the equipment they have on hand, often become fierce defenders of that equipment, arguing its merits, rather than, perhaps more rationally, striving to improve it.

Science fiction has offered some views of a computerized future that mention educational aspects, in such works as Arthur Clark's The City and the Stars. Often the views presented in such literature are hostile. For example, the

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computer-teacher in Zamatien's We is not a positive thing, but aids in dehumanizing the society.

But George Leonard's book, Education and Ecstasy, shows a positive, and, I believe, extremely interesting view of the role computers may play in learning. This view is almost unknown to the developers of learning materials employing the computer, so I intend to review Leonard's picture of the future. This, like all predictions, must be taken with a grain of salt; Leonard suggests as much in the introduction to the two chapters of the book that will concern us. One of my knowledgeable friends has characterized the passages as romantic. I believe, nevertheless, that they do represent an interesting view of the future, even if time should prove them not accurate in all details.

Leonard's book combines two seemingly unrelated trends in modern society, the encounter group philosophy of such establishments as Esselin, and the technological, even Skinnerian, approaches to education, particularly those involving the computer. In earlier didactic chapters he brings these possibilities together while criticizing education as it exists today.

The main interest in Education and Ecstasy, to me, is in the chapters that portray a school of the year 2001. The description uses the fictional guise of a visit by parents to the school to watch the progress of their children. We get a panoramic view of the learning activity, and we see the overall "philosophy" underlying the school.

The learning structure pictured is completely dependent on the existence of the computer, and would be impossible without advanced technology. The computer technology depicted is graphic, employing large three-dimensional, color pictures, and sound, in addition to alphanumeric interactions.

The main arena for the knowledge-based forms of education is the Basics Dome. Students enter and leave freely; the entire school is unscheduled, stressing that students are free to do anything they want to do. Thus, students do not appear for "classes" at any particular time inasmuch as there are no classes!

The students are three to ten year olds. After age ten people are expected to know all the "basic" information, including calculus! Since the time is free, enormous thought has to be given to motivational issues, so that the students will want to do the necessary tasks, rather than be coerced to do them as is often the situation in schools today.

The educational view presented, the free learning view is a natural extension of the self-paced or Keller plan ideas that are now coming into practice, with much more emphasis given to complete freedom from scheduling, and with the material much more highly individualized than at present.

Students entering the Basics Dome see a ciruclar ring of computer consoles around the outer wall. Each has a keyboard, allowing access to all human symbols, not just the restricted or full ASCII, or APL set, typical today. The technology for allowing access to all symbols is available

and has been built into the PLATO system; but the standard terminals today deny us this feature. Each student has headphones for audio messages. The display is a large three-dimensional holographic display in full color. The displays touch each other at the edges, so that the room has a continuous band of pictorial information. This touching is more than simply physical; the computer is clever enough to have the displays interact, and information may spread over more than one display, moving and contracting. Furthermore, displays will have in their intermediate areas related aspects of what the students at each of the stations are doing.

Students are identified to the computer by means of an electronic identification device, which they attach to the chair. This device also does queueing. The computer has complete records of students' efforts, so whenever students resume work it is all ready. A session starts with review and then moves on to new items. The individual sessions shown are not long.

A sample session of languge learning is sketched. As one would expect, this is difficult to do, and, while interesting, is perhaps one of the weaker features of the chapter. Writers about the future often have this problem. It is easier to imagine the overall structure than to delineate concrete details. This sketch is done much better in this book than in B. F. Skinner's Walden II, where a great discrepancy separates the glowing philosophy and the mundane details.

Graphics play a vital role. This trend is already established in contemporary education, but still is not as widely recognized as it should be. Almost all of the current major educational developmental projects in the United States are graphic based. I regard it as an historical accident that earlier terminals were nongraphic, forcing users of the computer in learning situations to begin with nonpictorial formats. The role of pictures is so important in all educational processes, in a variety of levels, that this seems to me to be an intolerable situation. Now that reasonably priced and highly reliable graphic terminals are available, I expect the situation to change. We could even argue that extensive nongraphic developmental work is a waste of time today. The future of computers in education will almost certainly be highly pictorial, allowing teachers to access to these important nonverbal learning techniques.

The learning environment in Education and Ecstasy is a computer-managed environment, with the computer knowing the educational progress of each student and making judgments based on this knowledge within the learning material. Each student is an individual with a highly individualized learning sequence. This is a long-standing goal for computers in education, even though it remains difficult to achieve in full-scale systems. We are now beginning to see systems that do this, systems where extensive memory of students' efforts and achievement both on and off the computer, is accessible to the program.

At least two aspects of the technology pictured are far beyond anything possible today (and probably beyond what will be available in 2001). The first, in active use in the school we visit, is the use of brain wave information within the learning dialogs. The headset which brings the sound also picks up brain patterns, allowing the computer to determine what the student is absorbing, whether the material needs to be reviewed, whether the program can accelerate.

The second advanced technological innovation, more radical and "criticized" by the "conservative" school director, involves direct brain manipulation, bypassing the senses entirely. Naturally the details are vague and it is not clear if the criticism is tongue-in-cheek or is the usual resistance to new educational developments. Contemporary readers are almost certain to approach this with apprehension; such future possibilities have often been the subject of frightening fictional presentations, such as John Hershey's The Child Buyer. It seems unlikely that any such technique would be in use in just twenty-five years.

I hope I have encouraged at least some of you to read the book, which includes many more details.

How realistic is this view of the future? What alternate patterns are plausible? In discussions with friends, alternative views have been expressed, both the view that the picture presented is much too radical a change to occur in twenty-five years, and the view that changes will be much more drastic than those suggested. I don't know how to pick between these two positions! The notion that educational

change occurs only slowly is ingrained, and does seem to have empirical basis. The vested interests in maintaining the system as it is are powerful. So desirable educational change is not rapid.

On the other hand, we are in a period of very rapid change in computer technology. Computers are becoming more economical while everything else is increasing in cost, promising that highly computerized educational systems will come into widespread use in the 80's and 90's. Economic considerations alone will be an important factor in pressing for such change, provided viable teaching materials can be developed in sufficient time.

This last factor, the existence of the pedagogical and programming skills discussed in Education and Ecstasy, is much more questionable than the hardware. None of our current computer-based education projects show such sophistication in computer use in educational situations, although many projects are striving to use computers more effectively. We still have a long way to go.

Even the hardware aspect is not entirely clear. The environment projected is a timesharing environment, with the central computer holding the record capabilities. There is probably local processing at the displays. Except for record keeping and large databases, future use may not be in the timesharing mode, but may tend toward sophisticated stand-alone machines. A striking aspect of recent technology has been the development of more and more compact computers. We have now many competing "computer-on-a-chip" assemblies

which can be put together to form systems. This development of microcomputer technology will continue, with the units becoming cheaper, faster, and easier to assemble for the purposes at hand.

To think of today's minis is misleading. The power of such systems in the near future will be more comparable to that of very large contemporary computers, even though these systems will be largely self-contained and stand-alone. Modern video-based technology will, I believe, have great ramifications too; it also suggests the possibility of very powerful local processing. The local processor can drive displays without timesharing limitations, and interactive computer graphics can overcome the limitations of a 1200 baud connection.

George Leonard's view of the future is only one of many. But such speculation, such description of ideal future conditions in a broad and sweeping sense, is important for developers of computer-based material. It is easy to become frozen in the hardware and technology available at the moment, and so waste years of time preparing materials that will only be obsolete when they are finished. Perhaps nowhere is the future shock phenomenon likely to be more important than in areas touched by the computer, because of the very rapid advances. Whether you accept George Leonard's view or not, or perhaps just deem it an interesting possibility, the need for long-range thinking and speculation about the future is important for all of us.